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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/613,217	07/03/2003	Thomas W. Tombler JR.	ATO-002.00	7063

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EXAMINER	
BUEKER, RICHARD R	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 01/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/613,217	TOMBLER ET AL.	
	Examiner	Art Unit	
	Richard Bueker	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) *26-36* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-25, drawn to an apparatus, classified in class 118, subclass 725.

II. Claims 26-36, drawn to a process, classified in class 427, subclass 596.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus could be used in a materially different process such as annealing the substrate.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Mr. Yu on January 3, 2005 a provisional election was made with traverse to prosecute the invention of group I, claims 1-25. Affirmation of this election must be made by applicant in replying to this Office action. Claims 26-36 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim

remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Applicants are required to provide the missing information relating to the co-pending applications described in paragraphs 1 and 2 of page 6 of their specification.

Claims 1-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claims 1 (line 7), 3, 5, 6 and 12, the phrases "the work region" or "said work region" lack proper antecedent basis and are unclear, vague and indefinite because claim 1 defines a plurality of different work regions, and it is unclear which of these previously defined work regions are being referenced by the above identified phrases. In claim 9, line 2, "to" apparently should be "for". In claim 12 the phrase "positionable in at least height and direction of gas flow toward said work region" is written in non-idiomatic English, and it is suggested that this phrase be changed to "positionable to provide it with a desired height and direction of gas flow with respect to said work region", or some similar language. In claim 14, the phrase "any work region among said workpiece" should be changed to "any work region of said workpiece".

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: The subject matter of claims 17 and 18 is not in the specification.

Claims 17 and 18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The specification fails to describe or explain the subject matter of claim 17. The specification fails to explain the purpose of cooling to -250° C as implied by claim 17 or what kind of cooling means is used to cool to a temperature of -250° C, or if cooling to -250° C is actually required or not. An analogous problem exists for the temperature of heating in claim 18.

Claims 17 and 18 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The language of claims 17 and 18 is unclear. It is not clear whether claim 17 requires the claimed stage temperature control unit to be able to cool the workpiece to -250° C, or to cool the workpiece to 250° C lower than "a processing temperature", or to cool the workpiece to below "equilibrium room temperature. It is not clear whether claim 18 requires the claimed stage temperature control unit to be able to heat the workpiece to 1200° C, or to heat the workpiece to above 0° C, or above "equilibrium room temperature" or to some temperature that is above 0° C but below 1200° C. It is noted that applicants' specification provides no guidance regarding applicants' intended meaning for the language of claims 17 and 18.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-5 and 9-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (2002/0127170) taken in view of Hongo (5,182,231) and Rohmund (J. Vac. Sci. Technol. B). Hong (see Fig. 14, for example) discloses an apparatus for fabricating nanotubes on workpieces including a stage for supporting a workpiece, a radiating energy source such as a laser system that emits laser beams that can heat a work region of the workpiece without heating another work region of the workpiece, and a feedstock delivery system. The feedstock delivery system has a temperature controller 500 connected to the gas feed line to maintain a temperature such that a catalyst precursor can be injected in gas phase (see paragraphs 29-31 of Hong. Hongo also discloses a laser CVD system that includes a feedstock gas delivery system analogous to that of Hong. Hongo teaches (see Fig. 1 and col. 8, lines 1-4) that a heater should be provided to preheat the feedstock gas delivery line when delivering metal carbonyl vapor because the metal carbonyl precursor compound is solid at room temperature and its vapor pressure is low. It would have been obvious to one skilled in the art to use a heater as Hong's feedstock gas delivery line temperature controller 500 (Fig. 14 of Hong) because Hongo teaches that a gas line heater is needed because a metal carbonyl is solid at room temperature and its vapor pressure is low. It is noted that the metal carbonyl precursors of Hongo (col. 8, lines 42-49) are of the same type as Hong's (paragraph 29) (i.e. metal carbonyls that are solid at room temperature) and in particular both Hong and Hongo suggest a nickel precursor such as nickel carbonyl. It is noted

also that Hong's feedstock delivery system passes all the feedstock gases through his temperature-controlled gas feed line. Also, applicants' specification (page 7, lines 11-15) clearly states that applicants' feedstock delivery system is intended to be for delivering feedstock gases such as "metal vapors or the like", which in the context of nanotube fabrication is taken to mean metal containing precursors such as the metal carbonyls that are conventionally used in this art to form catalyst deposits. Rohmund also discloses an apparatus for fabricating nanotubes by heating with a laser. Rohmund is cited for his teaching (see Fig. 1 and page 803, col. 1, lines 1-3) that the workpiece is held on a stage (substrate holder). Thus, while Hong does not provide a detailed description of his workpiece holder, Rohmund makes clear that it was conventional practice in the prior art to place the workpiece on a stage, and it would have been obvious to one skilled in the art to provide the apparatus of Hong with a workpiece holding stage as taught by Rohmund. Regarding claims 4 and 5, Rohmund also teaches the use of an infrared laser (CO_2 laser) to fabricate nanotubes on a workpiece. It would have been obvious to one skilled in the art to use an infrared laser as the laser in Hong's apparatus because Rohmund teaches that an infrared laser can successfully be used for Hong's purpose, which is to fabricate nanotubes on a workpiece. Regarding claims 14 and 15, it is noted that phrases such as "the stage can be translated or rotated" and "said radiating energy source can be translated or rotated" are recitations of intended use, and as presently phrased they do not require the claimed apparatus to have any added structural elements. For example, the stage and the laser of Hong are inherently capable of being moved or rotated manually by a

human operator. In claims 14 and 15, applicants should recite a means or mechanism for translation or rotation. Regarding claim 16, Rohmund teaches (see page 803, col. 1, lines 1-3) that nanotubes can desirably be fabricated by heating a substrate holding stage by a resistance heater in addition to localized heating with a laser, and for that reason it would have been obvious to one skilled in the art to provide the stage of Hong with a temperature control unit. Regarding claims 17 and 18, it is noted that Hong's apparatus inherently includes the capability for cooling the workpiece down from the processing temperature, and for heating the workpiece up from room temperature. Claims 17 and 18 can be interpreted to require nothing more than this.

Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (2002/0127170) taken in view of Hongo (5,182,231) for the reasons stated in the rejection of claim 1 above, and taken in further view of Gordon (4,423,956) (Fig. 2 and col. 5, lines 27-32) and Fukuda (5,496,410) (Fig. 1 and abstract) who both teach that it is desirable to use a resistive heater to heat a gas outlet of a feedstock gas supply pipe to prevent condensation and clogging of the pipe and its outlet. It would have been obvious to one skilled in the art to use a resistance heater to heat the feedstock supply pipes and pipe outlets of Hong and Hongo because Gordon and Fukuda teach that a resistance heater will successfully prevent undesired condensation of a precursor gas.

Claims 4-5 and 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (2002/0127170) taken in view of Hongo (5,182,231) and Rohmund for the reasons stated in the rejection of claim 1 above, and taken in further view of Dai (WO 02/081366), who also discloses a localized heating apparatus for fabricating nanotubes,

including localized heating by focused infrared beam or laser beam (page 5, lines 2-4). Dai further teaches the step of translating the workpiece holder relative to the laser beam in order to facilitate processing all work regions of a workpiece. It would have been obvious to one skilled in the art to provide means for translating the workpiece holding stage of Hong in view of Dai. Regarding claims 16-18, it is noted that Dai teaches providing temperature control means for cooling the workpiece down from the processing temperature, and for heating the workpiece up from room temperature. Claims 17 and 18 can be interpreted to require nothing more than this.

Claims 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (2002/0127170) taken in view of Hongo (5,182,231) and Rohmund for the reasons stated in the rejection of claim 1 above, and taken in further view of Nassuphis (6,033,721) and/or Murakami (6,090,458). Rohmund (page 810, col. 1, lines 15-20) teaches the step of using localized laser heating to form patterns of nanotubes by laser scanning. Laser scanning CVD to form patterns is a well-known prior art procedure, as exemplified by the teaching of Nassuphis (see Figs. 1-10 and col. 3, lines 40-43, for example) and Murakami (see Figs. 1-11 and col. 3, lines 27-38) who teach that laser scanning CVD is performed by moving the substrate and laser beam relative to each other, either by moving the substrate or moving the laser beam. It would have been obvious to one skilled in this art to use the laser CVD apparatus of Fig. 14 of Hong for forming patterns of nanotubes by scanning laser CVD because Rohmund teaches that forming nanotube patterns by scanning laser CVD is desirable. It also would have been obvious to provide the apparatus of Fig. 14 of Hong with means to translate or rotate the

scanning CVD is performed by moving the substrate and laser beam relative to each other, either by moving the substrate or moving the laser beam. It would have been obvious to one skilled in this art to use the laser CVD apparatus of Fig. 14 of Hong for forming patterns of nanotubes by scanning laser CVD because Rohmund teaches that forming nanotube patterns by scanning laser CVD is desirable. It also would have been obvious to provide the apparatus of Fig. 14 of Hong with means to translate or rotate the substrate holding stage relative to the laser, because Nassuphis and Murakami teach that this is how laser scanning CVD is conventionally performed.

Claims 16, 18 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (2002/0127170) taken in view of Hongo (5,182,231) for the reasons stated in the rejection of claim 1 above, and taken in further view of Smalley (6,683,783) (col. 23, lines 14-16), who teaches that an electromagnetic field can be applied to orient nanotubes during growth for affecting the direction of growth of the nanotubes as claimed in claim 25. It would have been obvious to one skilled in the art to provide an adjustable magnetic field generator for the apparatus Hong because Smalley teaches that it is desirable to affect the direction of growth of nanotubes by using an electromagnetic field. Regarding claims 16 and 18, Smalley teaches (col. 25, lines 26-54) that a workpiece should be heated in a range up to 1200° C during nanotube fabrication using laser CVD. It would have been obvious to provide the apparatus of Fig. 14 of Hong with a stage temperature control unit for "helping" to control the temperature of a workpiece at temperature of 1200° C because Smalley teaches 1200°

C as a desirable temperature for Hong's purpose, which is to fabricate nanotubes. It is noted that the claimed stage temperature control unit can be the laser beam.

Claims 1-3, 9-24 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Jang (6,180,049) (Figs. 1-5) who discloses an apparatus including a stage for supporting a workpiece, a laser that can be focused on a workpiece supported on said stage to locally heat a work region of said workpiece, and a feedstock delivery system that delivers gas to a work region on a workpiece, wherein the feedstock delivery system includes a feedstock heating system (see Fig. 4, element 60, and col. 8, lines 58-60). It is noted that the claim 1 phrase "a stage *for* supporting a workpiece, said workpiece having catalyst thereon" (emphasis added), is a recitation of intended use for the claimed stage. The apparatus as claimed does not include any workpiece, with or without a catalyst. The stage of Jang's apparatus is inherently capable of supporting a workpiece that has catalyst on it. Jang also teaches (col. 9, lines 45-49) the desirability of providing a temperature control unit for his stage, both for heating and cooling as claimed in claims 16-18.

Claims 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jang (6,180,049) for the reasons stated above, taken in further view of Gottsleben (5,164,222) (Figs. 1 and 2 and paragraph bridging cols. 2 and 3) who teaches that a cooling unit or heating unit of the type suggested by Jang should be built into the stage that holds the workpiece. It would have been obvious to one skilled in the art to incorporate the temperature control unit suggested by Jang into the workpiece holding

stage because Gottsleben teaches that a workpiece temperature can successfully be controlled in this manner.

Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jang (6,180,049) in view of Hongo (5,182,231), Gordon (4,423,956) (Fig. 2 and col. 5, lines 27-32) and Fukuda (5,496,410) (Fig. 1 and abstract). Hongo, Gordon and Fukuda teach that it is desirable to heat a gas supply line to prevent condensation and clogging of the line, and it would have been obvious to heat the gas supply line of Jang for this reason.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard Bueker whose telephone number is (571) 272-1431. The examiner can normally be reached on 9 AM - 5:30 PM, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (571) 272-1439. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Richard Bueker
Primary Examiner
Art Unit 1763